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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/833,016	04/10/2001	Shilin Chen	SC-98-25A	1340
7590	09/23/2005		EXAMINER	
Charles I. Gholz 1755 Jefferson Davis Highway 4th Floor Arlington, VA 22202			JONES, HUGH M	
			ART UNIT	PAPER NUMBER
			2128	

DATE MAILED: 09/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	09/833,016	CHEN, SHILIN	
	<b>Examiner</b> Hugh Jones	<b>Art Unit</b> 2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on 30 August 2004.
- 2a) This action is FINAL.                    2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 40,42,43,47 and 51-64 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_\_ is/are allowed.
- 6) Claim(s) 40,42,43,47 and 51-64 is/are rejected.
- 7) Claim(s) \_\_\_\_\_ is/are objected to.
- 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 30 August 2004 is/are: a) accepted or b) objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. §§ 119 and 120

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) All b) Some \* c) None of:  
1. Certified copies of the priority documents have been received.  
2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 13) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
a) The translation of the foreign language provisional application has been received.
- 14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

#### Attachment(s)

- 1) Notice of References Cited (PTO-892)  
2) Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) Information Disclosure Statement(s) (PTO-1449) Paper No(s) *7/16/04*  
4) Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.  
5) Notice of Informal Patent Application (PTO-152)  
6) Other: *8/30/04*

## DETAILED ACTION

### Introduction

1. **Claims 40, 42-43, 47, 51-64 of U. S. Application 09/833,016, filed on April 10, 2001 are presented for examination.**

### Interference

2. **Applicant have cancelled all earlier versions of claims and requested that Examiner declare an Interference (8/30/2004) against U. S. Application 09/635,116.** Claims 40, 42-43, 47, 51-64 of this application are alleged by applicant to correspond to all claims of U.S. Patent No. 09/635,116.

3. Before an Interference can be declared, the Examiner must determine that there is interfering subject matter claimed in the application (against the copied claims) which is patentable to the applicant subject to a judgment in the interference. The interfering subject matter will be defined by one or more counts. The application must contain, or be amended to contain, at least one claim that is patentable over the prior art and corresponds to each count. The claim in the application need not be, and most often will not be, identical to a claim in the patent. All claims in the application and patent which define the same patentable invention as a count shall be designated to correspond to the count.

4. Claims 40, 42-43, 47, 51-64 of this application have been copied by the applicant from U. S. Application 09/635,116. These claims are not patentable to the applicant because of the claim rejections, subsequently presented.

**5. An interference cannot be initiated since prerequisite for interference under 37 CFR 1.606 is that the claim be patentable to the applicant subject to a judgement in the interference.**

**Claim Rejections - 35 USC § 112**

**6. The following is a quotation of the first paragraph of 35 U.S.C. 112:**

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

**7. Claims 40, 42-43, 47, 51-64 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for the simulating, as expressly disclosed in the specification, does not reasonably provide enablement for calculating any other simulation. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention commensurate in scope with these claims. The dependent claims inherit the defect.**

**8. The specification does expressly disclose the simulation or optimization in so far as it expressly defines certain variables which are to be simulated and optimized. The specification refers to two papers by Ma (lines 2-14, page 7, specification) which disclose various details; however, the Ma papers were not incorporated by reference and thus are not part of the specification. However, the specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention commensurate in scope with these claims. There is no support for enablement**

other than the express disclosure, namely, the specification expressly defining certain variables which are to be simulated and optimized.

**9. Claims 40, 42-43, 47, 51-64 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a bit with three roller cones, does not reasonably provide enablement for a bit with any other number of roller cones.** The amendment to the specification (amendment to pages 21-22 – see paper # 17) appears to indicate that the range (for axial force distribution between rollers, for example) is between 31-35 %. The total percent can only be 100%. At most two rollers could only account for  $2 \times 35\% = 70\%$ , which is not possible; four rollers would account for, at minimum,  $4 \times 31\% = 124\%$ , which is also not possible. On the other hand  $3 \times 33 \frac{1}{3}\% = 100\%$ , which would make sense. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention commensurate in scope with these claims. The dependent claims inherit the defect.

**10. Claims 40, 42-43, 47, 51-64 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement.** The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

- Pages 21-22 of the specification mention six possible embodiments but provide no substantial detail other than a mere listing of steps. It is also noted that the "means for" language in the specification (line 16, page 22 – "performing an **optimization means**") appears to be an improper attempt at incorporation by reference.

11. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

12. **Claims 40, 42-43, 47, 51-64 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.**

The use of the phrase "based on", which is recited in all independent claims, renders the claims ambiguous. Such a phrase does not particularly point out and distinctly claim that which Applicant considers to be the invention. Although it is noted that there is "means for" language such as "means for determining an axial force", that the "based on" is not in a "means for" structure. Applicants are reminded that such limitations do not invoke 112(6) paragraph ("means for" or "step for"). This follows from analysis of the claims and from Applicant's statement in the specification (lines 16-22, page 23):

"None of the description in the present application should be read as implying that any particular element, step, or function is an essential element which must be included in the claim scope: THE SCOPE OF PATENTED SUBJECT MATTER IS DEFINED ONLY BY THE ALLOWED CLAIMS. Moreover, none of these claims are intended to invoke paragraph six of 35 USC section 112 unless the exact words "means for" are followed by a participle."

The meaning of "based on" is unknown. Thus, the claims are ambiguous.

13. **The term "substantially" in claim 57 is a relative term which renders the claim indefinite. This appears to be the only instance of the use of "substantially", but the rejection applies to any other instance, if it does**

**exist.** The term "substantially" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. It is noted that the amendment to the specification (amendment to pages 21-22 – see paper # 17) appears to indicate that the range corresponding to "substantially" is between 31-35 %; however, this does not resolve the issue for the following reasons. The total percent can only be 100%. So if the percent on each of three bits is 35%, for example, the total would be 105%, which is not possible. If the percent is 31% on each of three bits, then the total would be 93%, which is not possible.

#### Claim Interpretation

14. The subsequent prior art rejections are asserted in view of the following claim analysis.

15. The claims do not invoke 112(6) paragraph ("means for" or "step for"), except as expressly recited. For example, the phrase "based on" does not invoke 112(6) paragraph. This follows from analysis of the claims and from Applicant's statement in the specification (lines 16-22, page 23):

"None of the description in the present application should be read as implying that any particular element, step, or function is an essential element which must be included in the claim scope: THE SCOPE OF PATENTED SUBJECT MATTER IS DEFINED ONLY BY THE ALLOWED CLAIMS.. Moreover, none of these claims are intended to invoke paragraph six of 35 USC section 112 unless the exact words "means for" are followed by a participle."

Claim Rejections - 35 USC § 103

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

17. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

18. **Claims 40, 42-43, 47, 51-64 are rejected under 35 U.S.C. § 103(a) as being unpatentable over [Ma et al. ("The computer simulation of the interaction between roller bit and rock" – 1995 – *of record*) or Ma ("The operational mechanics of the rock bit" – 1996 - *of record*)] in view of [Warren et al.] and in further view of [Applicant's Own Admission].**

19. Ma et al. ("The computer simulation of the interaction between roller bit and rock" – 1995 – *of record*) discloses:

***optimal roller bit design using computer simulation* (entire paper);**

***operational mechanics of the roller bit geometry*** ("The model of bit and bottom"; "roller bit"; "bottom hole");

***kinematics of the bit*** ("The model of bit and bottom"; rotation angle of cone"; "The simulation of interaction");

***rock-bit interaction*** and crater analysis ( "crater model"; "Interaction between bit and rock");

***bit design including force analysis*** ("The simulation of Interaction").

20. Ma ("The operational mechanics of the rock bit" – 1996 - *of record*) discloses:

***optimal roller bit design using computer simulation*** (chapter 6) based on the entire teachings in the book, including

***operational mechanics of the roller bit geometry*** (details in chapter 2);

***kinematics of the bit*** (details in chapter 3);

***rock-bit interaction*** (details in chapter 5); and

***bit design including force analysis*** (see page 232: "evaluate the size, load, motion, stress, and strain of each part...").

21. Ma et al. (1995) or Ma et al. (1996) do teach optimal design but do not expressly teach that the optimal design consists of

- balancing the forces over the three rollers (as implied by the independent claims, for example);

22. It would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the teachings of Ma et al. to consider as optimal design such a design wherein the forces and volumes are balanced among rollers and further to maximize the drill rate for the following reasons. It was well known in the art at the time of the invention to those of ordinary skill in the art that a

pervasive problem in the industry was that of unbalanced forces on bits resulting in drill bit whirl further resulting in a decrease of drill penetration rate.

23. Warren et al. disclose **teach that the issues relating to bit imbalance were well known and studied in the prior art for at least the last decade.**

Warren et al. further teach the dependence of drill penetration rate on relative force balance.

In particular, note col. 1, line 28 to col. 2, line 21:

"Numerous studies have been made to find out what causes such destruction to the cutting elements. The inventors hereof have previously found that a substantial portion of the destructive forces are generated by radial imbalance forces that cause a drill bit to rotate about a rotational axis offset from the geometric center of the drill bit in such a way that the drill bit tends to wobble or "backwards whirl" about the borehole. This backwards whirling causes the center of rotation to change dramatically as the drill bit rotates about the borehole. Thus, the cutting elements travel faster, sideways, and backwards and thus are subject to greatly increased impact loads which cause the destruction of the cutting elements."

More specifically, circumferential drilling imbalance forces exist to some degree on every drill bit and these forces tend to push the drill bit towards the side of the borehole. In a typical drill bit, gauge cutting elements are designed to cut the edge of the borehole. During the cutting process, the effective friction between the cutting elements near the gauge area increase and, thus, the instantaneous center of rotation becomes some point other than the geometric center of the drill bit. When this happens, the usual result is for the drill bit to begin to backwards whirl around the borehole. This whirling process regenerates itself because sufficient friction is always generated between the drill bit gauge area and the borehole wall, no matter what the orientation of the drill bit, from the centrifugal forces generated by the rapid acceleration of the drill bit.

Various methods and equipment have been proposed to eliminate or reduce these imbalance forces, including using dynamically balanced lower drill string assemblies and very precisely aligning the cutting elements to reduce imbalance forces.

Various designs of drill bits have been developed to improve penetration rates by aligning the cutting elements in a plurality of equal radius sets, with each set being in overlapping radial relationship. One such drill bit design is disclosed in U.S. Pat. No. 4,545,441. Further, various attempts at improving cutting element life have been made by varying the back or side rake or angle of attack of the cutting elements, i.e., the angle at which the face of the cutting element addresses the formation with

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respect to the formation surface. The benefits of varying such back rake angles are disclosed in "The Effect Of Back Rake On The Performance Of Small-Diameter Polycrystalline Diamond Rock Bits: ANOVA Tests," Journal of Energy Resources Technology, Vol. 108, No. 4, pp. 305-309, December 1986; U.S. Pat. No. 4,660,659; U.S. Pat. No. 4,440,247; U.S. Pat. No. 4,186,628 and U.S.S.R. Pat. No. 395,559. The effects of varying side rake angles is disclosed in Hunnj SPE-10152 (1981).

There is no disclosure or suggestion in any of the above-identified article or patents of arranging cutting elements specifically to prevent or reduce the effects of destructive bit whirl. **There is a need for a drill bit design which incorporates features designed specifically for preventing bit whirl and improving cutting element life."**

Thus, It would have been obvious to one of ordinary skill in the art at the time of the invention was to modify the teachings of Ma et al. to consider as optimal design such a design wherein the forces and volumes are balanced among rollers.

24. It would have further been obvious to one of ordinary skill in the art at the time of the invention was made that if the Ma et al. teachings incorporated an optimal condition wherein the forces were balanced among rollers; that it would have been further obvious to one of ordinary skill in the art at the time of the invention to further modify the Ma et al. teachings to balance the volume of earth cut among the rollers. There is a direct and inherent (as well as obvious) relationship between energy, drill rate, applied force and resultant removed volume of formation. This follows from Newton's laws of motion. This inherent relationship has also been recognized by Applicants when they admit (lines 4-11, page 20, specification) that:

"The geometric parameters of the roller cone bit are then modified such that the volume of formation removed by each cutting structure is equalized. Since the amount of formation removed by a cutting structure is a function of the force imparted on the formation by the tooth, the volume of formation removed by a cutting structure is a direct function of the force applied to the cutting structure. By balancing the volume of formation removed by all cutting structures, force balancing is also achieved."

Response to Arguments

25. Applicant's arguments filed 8/30/2004 have been fully considered but are not persuasive.
26. The objections to the drawings are withdrawn in view of the amendment to the drawings.
27. The claim objections are withdrawn in view of the amendment to the claims.
28. Applicants are thanked for their information disclosure statement and for their response to the 1.105 requirement.
29. The 112(1) enablement rejection pertaining to simulation is withdrawn and is regardless moot in view of the new scope of enablement rejection. In any case, reliance on the '225 patent would not cure the deficiency. Each application is examined on its own merits.
30. The scope of enablement rejection pertaining to the issue of the number of rollers is maintained . Applicants have only provided argument where evidence is required. Reliance on the '225 patent does not cure the deficiency because each application is examined on its on merits. It is noted that Applicants have not actually argued the merits of the rejection.
31. The 112(2) rejection pertaining to "the last limitation" is withdrawn in view of the amendment.
32. Applicant's commentary pertaining to other applications on page 26 is not an appropriate argument against the 112(2) rejection.
33. The 112(2) "missing steps" rejections are withdrawn in view of Applicant's arguments.

34. The original 112(2) rejection relating to the use of "substantially" is withdrawn in view of the claim amendment. However, Applicants now use the same language in a new claim. Please note the new 112(2) rejection.
35. The double patenting rejections are withdrawn in view of the two Terminal Disclaimers, which were submitted in response to the double patenting rejections.
36. Applicant's arguments pertaining to the 102 rejections are moot in view of the cancellation of claims 34, 36-39, 46, 50.
37. Applicant's arguments pertaining to the 103 rejections are not persuasive. Applicant's commentary pertaining to other applications on page 30 is not an appropriate argument against the 103 rejection. Applicants have not actually discussed the prior art references, let alone the combination. For example, Ma et al. ("The computer simulation of the interaction between roller bit and rock" – 1995 – *of record*) discloses:
- optimal roller bit design using computer simulation*** (entire paper);
- operational mechanics of the roller bit geometry*** ("The model of bit and bottom"; "roller bit"; "bottom hole");
- kinematics of the bit*** ("The model of bit and bottom"; rotation angle of cone"; "The simulation of interaction");
- rock-bit interaction*** and crater analysis ("crater model"; "Interaction between bit and rock");
- bit design including force analysis*** ("The simulation of Interaction").
38. In another example, Ma ("The operational mechanics of the rock bit" – 1996 – *of record*) discloses:

***optimal roller bit design using computer simulation*** (chapter 6) based on the entire teachings in the book, including

***operational mechanics of the roller bit geometry*** (details in chapter 2);

***kinematics of the bit*** (details in chapter 3);

***rock-bit interaction*** (details in chapter 5); and

***bit design including force analysis*** (see page 232: "evaluate the size, load, motion, stress, and strain of each part...").

39. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

40. **Applicant have cancelled some of the claims and added new claims and requested that Examiner declare an Interference against U. S.**

**Application 09/635,116.** Claims 40, 42-43, 47, 51-64 of this application are alleged by applicant to correspond to all claims of U.S. Patent No. 09/635,116.

41. Before an Interference can be declared, the Examiner must determine that there is interfering subject matter claimed in the application (against the copied claims) which is patentable to the applicant subject to a judgment in the interference. The interfering subject matter will be defined by one or more counts. The application must contain, or be amended to contain, at least one claim that is patentable over the prior art and corresponds to each count. The claim in the application need not be, and most often will not be, identical to a claim in the patent. All claims in the application and patent which define the same patentable invention as a count shall be designated to correspond to the count.

42. Claims 40, 42-43, 47, 51-64 of this application have been copied by the applicant from U. S. Application 09/635,116. These claims are not patentable to the applicant because of the claim rejections, presented earlier.

43. **An interference cannot be initiated since a prerequisite for interference under 37 CFR 1.606 is that the claim be patentable to the applicant subject to a judgement in the interference.**

**Conclusion – Prior Art Made of Record**

44. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following are considered cumulative to the applied prior art and therefore have not been applied in prior art rejections:

- Ma et al. ("Dynamics of roller cone bits" – 1985 – *of record*).
- Ma et al. ("Kinematics of the cone bit" – 1985 – *of record*).
- Brett et al. (U. S. Patent 5,042,596) discloses an imbalance compensated drill bit that **takes advantage of undesired and destructive imbalance forces to prevent bit whirl**. Methods of designing and making such imbalance compensated drill bits are disclosed whereby a drill bit body has at least one cutting zone with a plurality of cutting elements extending therefrom and at least one bearing zone. The bearing zone has a relatively smooth surface and is located at a position where the net imbalance force (from the cutting elements) is directed towards. When the drill bit is rotated, the imbalance force presses the bearing zone against the borehole wall, and the bearing zone slips along the wall, thereby preventing the center of rotation to shift and create the destructive whirling motion. **Brett et al. teach that the issues relating to bit imbalance were well known and studied in the prior art for at least the last decade.**

Brett et al. (U. S. Patent 5,131,478) disclose that the issues relating to bit imbalance were well known and studied in the prior art for at least the last decade.

**See figure 17, in particular.**

Chen ("Linear and nonlinear dynamics of drill strings" – PH. D. Thesis of inventor –1995 – *of record*) discloses bit whirl kinematics (caused by force imbalance) and its analysis (chapter 5, in particular – note page 82 "Unbalance Force").

45. Any inquiry concerning this communication or earlier communications from the examiner should be:

**directed to:**

Dr. Hugh Jones telephone number (571) 272-3781, Monday-Thursday

0830 to 0700 ET, **or**

the examiner's supervisor, Jean Homere, telephone number (571) 272-3780.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist, telephone number (703) 305-3900.

**mailed to:**

Commissioner of Patents and Trademarks

Washington, D.C. 20231

**or faxed to:**

(703) 308-9051 (for formal communications intended for entry) **or**

(703) 308-1396 (for informal or draft communications, please label "PROPOSED" or "DRAFT").

Dr. Hugh Jones  
Primary Patent Examiner  
November 25, 2004

HUGH JONES, R.D.  
PRIMARY PATENT EXAMINER  
TECHNOLOGY CENTER 2100